

Technical Paper 382

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**A PARTIAL VALIDATION OF FORECAST
ENGAGEMENT SIMULATION EXERCISE
OUTCOMES**

Steven M. Medlin

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between field and forecast maneuver routes, and they tended to classify forecast casualty data as field exercise casualty data. Board war gaming provides realistic process and product data that cannot be distinguished from field exercise data. Although further validation research needs to be conducted, board war game forecasting has great potential for use in developing performance benchmarks against which unit performance can be compared.

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Technical Paper 382

A PARTIAL VALIDATION OF FORECAST ENGAGEMENT SIMULATION EXERCISE OUTCOMES

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**Combat Performance Standards
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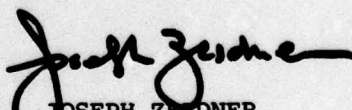
FOREWORD

The research presented in this paper was conducted under the Training and Education project in the Engagement Simulation Technical Area of the Army Research Institute for the Behavioral and Social Sciences (ARI). The goal of this project is to provide quantitative methods for evaluating unit proficiency. The means for achieving this goal include basic research in criterion-referenced test methodology, measurement and scaling models, and decisionmaking implications of test score interpretation.

Related, ongoing programs within the Technical Area include evaluation of small combat units under simulated battlefield conditions (REAL-TRAIN, ARTEP), qualification of tank crews and platoon gunnery (IDOC), and improvements in the reliability of ARTEP evaluation.

Anticipated future research under the Training and Education project includes the development of a computer model for performance evaluation and development of measurement, scaling, scoring, decisionmaking, and quality-control models for use in performance evaluations when criterion-referenced testing procedures are employed.

ARI research in this area is conducted as an in-house effort, responsive to the requirements of Army Project 2Q762722A764. Without the invaluable logistics support of the 4th Battalion of the 40th Armor from Fort Carson, however, the project would not have been possible.


JOSEPH ZEIDNER
Technical Director

A PARTIAL VALIDATION OF FORECAST ENGAGEMENT SIMULATION EXERCISE OUTCOMES

BRIEF

Requirement:

To evaluate the validity of board war game forecast data for use in determining benchmarks or standards against which unit performance in engagement simulation exercises can be compared.

Procedure:

Military experts attempted to distinguish between engagement simulation exercise data from the Combined Arms Test at Fort Carson, Colo., March 1978, and board war game exercise data generated by the Fort Carson Forecasting Game. An inability to differentiate between field and forecast data suggests that the two data sources can be considered to be identical and, consequently, that generated data can be used to develop behavioral benchmarks.

Findings:

Judgments were made on maps of maneuver routes and tables summarizing casualties suffered and weapon system inflicting casualty data. The military experts were not able to correctly classify maneuver route information as real (field) or simulated (game board) data. Furthermore, they tended to classify simulated casualty data as real.

Utilization of Findings:

Results from this study indicate that board war gaming provides realistic process and product data that military experts cannot distinguish from field exercise data. With continued research on its validation, the forecasting procedure can be used to develop performance benchmarks with which unit performance can be compared.

A PARTIAL VALIDATION OF FORECAST ENGAGEMENT SIMULATION EXERCISE OUTCOMES

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A PARTIAL VALIDATION OF FORECAST ENGAGEMENT SIMULATION EXERCISE OUTCOMES

INTRODUCTION

The Army Research Institute for the Behavioral and Social Sciences (ARI) is conducting research on improved training and evaluation systems for small combat units. One system currently under development is tactical engagement simulation (ES), a two-sided tactical field/maneuver exercise. To evaluate unit performance in ES exercises, performance benchmarks or standards must be defined. The dynamics of two-sided field exercises do not permit exact, deterministic standards, however. The standards must be in the form of probability distributions, tolerance limits, or principle-derived sets of correct solutions to tactical problems.

To establish standards in one or more of these formats, large amounts of ES outcome data must be obtained so that the characteristics of the distribution of ES outcomes can be determined. Because replication of field exercises is difficult and costly, the distribution of ES outcomes cannot be generated in field exercises. As part of the ES research program, therefore, inexpensive simulations of ES exercises are being developed to provide large amounts of valid ES outcome data.

In one of the current modeling efforts, the Combat Operations Training Effectiveness Analysis Model (COTEAM), the concept of situation-specific forecasting is being used to develop an ES outcome data base from which the characteristics of the distribution of ES outcomes can be determined. Situation-specific means that the forecasting procedures replicate the particular field exercise conditions as closely as possible; a forecasting exercise uses the same force ratios, weapons mix, terrain, weather conditions, and missions as the corresponding field exercise.

The purpose of the forecasting efforts is to generate a data base of ES outcomes from which expectations about tactical processes and casualties can be derived for units participating in ES field exercises. The methods being developed or adapted for generating the data base include (a) military experts' DELPHI, (b) board war games, and (c) computerized ES models. According to the COTEAM model, if the forecasts obtained using these methods agree with those observed in ES field exercises, then these methods can be used to develop performance criteria against which unit performance in ES exercises can be compared.

In assessing the similarities between forecasting data and observed field data, differences can be determined either statistically or using

the Turing Test.¹ The Turing Test states that if outputs from two different data sources are given to an information processor, and the processor cannot distinguish between the two data sources, then the data sources are considered to be identical.

Recent work by ARI suggests that behavioral forecasting is a viable means of developing an ES data base. During the REALTRAIN validation of rifle squads at Fort Ord, Calif., in May 1977,² military experts made forecasts about the outcomes of specific ES exercises. The data³ indicate that experts can make this type of forecast and that their forecasts are sensitive to such factors as the training and combat-readiness level of the unit being evaluated.

At the armor Combined Arms Test (CATEST) at Fort Carson, Colo., from January to April 1978, board war games⁴ were used to collect forecasting data about the ES field exercises. Using the Fort Carson Forecasting Game, a board war game specifically designed for the terrain and scenarios used in the CATEST, board exercises identical to ES field exercises were conducted. The results were assessed in terms of the tactical maneuver routes, casualties suffered, and casualties inflicted by each type of weapon system. The maneuver routes from the two types of exercises were comparable; however, the field maneuver routes tended to be slightly more complex than the board game routes. The casualties suffered were almost identical for both types of exercises, and the casualties inflicted by each type of weapon system were also similar. The only sizable differences were the percentages of casualties inflicted by tanks and casualties inflicted by artillery. These differences were attributed to slight variations in the way ES rules were enforced in the field exercises and in the board games.

The two studies (Mirabella, 1977; Medlin, 1979) established the feasibility of forecasting as a means of generating an ES data base. The data can be generated, and they closely resemble the data observed in field exercises. But how closely do they resemble field data? Do forecast data agree with field data enough to be used to develop

¹Turing, A. M. Computing Machinery and Intelligence. *Mind*, 1950, 59, 433-460.

²Banks, J. H., Hardy, G. D., Scott, T. D., Kress, G., & Word, L. E. REALTRAIN Validation for Rifle Squads: Mission Accomplishment. ARI Research Report 1192, October 1977.

³Mirabella, A. Criterion-Referenced System Approach to Evaluation of Combat Units. Paper presented at the 19th Military Training Association, San Antonio, Tex., October 19, 1977.

⁴Medlin, S. M. Behavioral Forecasting for REALTRAIN Combined Arms. ARI Technical Paper 365, May 1979.

behavioral benchmarks or standards? Ultimately, the final decision is a subjective one, but further research can help to establish the validity, or the similarity, between field and forecast data. As Medlin (1979) noted, because of the severe restrictions on sample size, no inferential statistics could be used to assess differences between the two types of data. Furthermore, since much of the data collected is "process" data (for example, on maneuver routes, firing positions, and overwatch positions), the results of statistical analyses may be misleading even if such analyses can be performed. Any of several maneuver routes, firing positions, or overwatch positions may be reasonable for a given exercise. Statistical analyses may show significant differences that are not in fact meaningful. Thus, it is not important to demonstrate statistical differences; rather, it is important that the forecasting procedure should generate expectations that are not significantly different to an information processor or a military expert from the outcomes observed in field exercises.

The present research attempted to partially validate, or establish, the similarities between forecast data and ES field exercise data by subjecting the data to the Turing Test. The study was to determine whether military officers can distinguish between forecast and field data (for example, the maneuver routes, casualties suffered, and casualties inflicted by weapon type) from the CATEST field exercises and from the corresponding board war games. As the Turing Test is applied in this context, if military officers cannot distinguish between generated and observed ES outcome data and cannot distinguish between the two sets of process data (one forecast and one collected in field exercises), then the two data sources are considered to be identical. This result would provide further support for the use of forecast data as a means of developing performance benchmarks or standards against which unit performance can be compared.

METHOD

Participants

Sixty-six military officers from the maneuver arms units at Fort Carson, Colo., served as participants for the study (see Appendix A). The officers participated in the experiment as part of their required weekly leadership training class.

Design

Booklets were constructed containing a background information sheet (Appendix A), a response sheet (Appendix B), three maps of maneuver routes from CATEST field exercises (Appendix C), three maps of maneuver routes from the corresponding Fort Carson Forecasting Game exercises (Appendix D), a table summarizing CATEST field exercise casualty data, i.e., casualties suffered by weapon systems inflicting

casualties (Appendix E), and a table summarizing forecast casualty data (Appendix F).

Excluding the background information and response sheets, the material in each booklet was randomly ordered to eliminate possible order or sequential effects. The background information sheet obtained information that might be related to an officer's ability to distinguish field exercise data from board war game data (for example, rank, combat experience, REALTRAIN experience, board war game experience, years in service, and education).

The response sheet provided space for the officer to indicate which map or table he was considering and whether he thought the data were real (field exercise data) or simulated (board war game data). The response sheet also provided a line marked from zero to 100 in increments of 10 on which the officer was to indicate "how much confidence" he had in his decision about whether the data were real or simulated. Finally, the response sheet provided a space in which the officer could indicate whether or not he was guessing, or, if not guessing, to indicate which factors influenced his decision. The six maps of maneuver routes were copies of observed field exercise data or the generated game data for the same exercise. The two tables of casualties were the summary table for the CATEST field exercises and the summary table for the Fort Carson Forecasting Game exercises.

Procedure

Each officer received a booklet containing all the necessary materials. The experimenter described the task to the officers and explained the background information sheet, response sheet, map data, and casualty data in considerable detail. Questions were answered as completely as possible without compromising the integrity of the experiment. Each officer then filled out the background information sheet, studied the map and casualty data, and filled out the response sheet. When all officers had finished and all booklets were collected, the experimenter debriefed the participants.

RESULTS

Maneuver Routes

Each participant was asked to indicate whether each of six maps of maneuver routes depicted real (field exercise) data or simulated (game board) data. Half of the maps were from field exercises and half were from game board exercises. If participants were not able to distinguish between the two types of data, they should guess correctly on three of the six maps. The mean number of correct responses was 2.99. Out of 396 responses (six for each of the 66 officers), 197 were correct, only 1 less than the 198 expected by chance. Table 1 shows distribution

of the number of correct responses. Most of the participants (50 out of 66) responded correctly on two, three, or four of the six maneuver route maps.

Table 1
Distribution of Number of Correct Responses

Number of correct responses	Frequency
0	1
1	7
2	18
3	19
4	13
5	3
6	5

Because of the difficulties inherent in trying to "accept" the null hypothesis (see Greenwald⁵ or Bakan⁶ for a discussion of the issues involved), confidence intervals for the "true" mean number of correct responses were constructed. The 99.5% confidence limits are 2.54 and 3.44, the 99% confidence limits are 2.59 and 3.39, and the 95% confidence limits are 2.71 and 3.27. Thus, one can be 95% certain that the "true" population mean lies between 2.71 and 3.27.

Even though the overall mean of correct responses is 2.99, it is possible that some systematic relationship exists between the real and simulated data and the responses of "real" and "simulated" given by the subjects. In the worst possible case, participants could correctly identify all the real exercises and misidentify all the simulated exercises, yet the observed mean would still be 3.00. As Table 2 shows, there is no systematic relationship between the source of the data and the participants' responses about the source of the data ($\chi^2 = 1.70$, $df = 1$, n.s.).

⁵Greenwald, A. G. Consequences of Prejudice Against the Null Hypothesis. Psychological Bulletin, 1975, 8(61), 1-20.

⁶Bakan, D. The Test of Significance in Psychological Research. Psychological Bulletin, 1966, 66(6), 423-437.

Table 2

Frequency That Real and Simulated Data Were
Classified Real and Simulated

	Real	Simulated
Classified as real	105	106
Classified as simulated	93	92

The above results indicate that, overall, the participants cannot distinguish between real and simulated maneuver routes. Certain individuals, however, may be able to discern one type of data from the other because of combat experience, years in service, or some other experiential background. Statistical analyses reveal that the number of correct responses does not differ as a function of rank, combat experience, REALTRAIN experience, board war game experience, familiarity with the exercise test lanes, years in service, or education.

Each participant also indicated how certain he was of his response and if he was guessing. The number of admitted guesses does not differ as a function of any of the background information, and the mean confidence response of the participants differs marginally ($t = -2.18$, $df = 64$, $p < .033$) as a function of REALTRAIN experience only. Officers with REALTRAIN experience were more confident of their responses than were participants with no REALTRAIN experience. Furthermore, neither confidence nor admitted guessing varied as a function of the correctness of the response.

Casualty Data

Participants were also given two tables, one from field exercise data and one from forecast data, that provided summary information on the casualties suffered and the casualties inflicted by each weapon system. The participants were asked to indicate which table contained data from field exercises. If they were unable to distinguish between the two types of data, the participants should have guessed correctly half of the time. Only 53 of the 66 participants responded to this question; of the 53, only 20 correctly determined the field exercise casualty data ($\chi^2 = 3.57$, $df = 1$, $p < .062$). Thus, there is tendency for the participants to classify the real data as simulated. None of the background data was related to the participants' ability to correctly classify the casualty information.

DISCUSSION

As part of ARI's research on improved training and evaluation systems, an evaluation system for two-sided tactical field/maneuver exercises is being developed. To evaluate unit performance and assess the units' combat readiness and/or training deficiencies and proficiencies, performance standards or benchmarks must be defined. The COTEAM model uses the concept of situation-specific forecasting to provide benchmarks. Because of the nature of the two-sided tactical play, however, the standards cannot be exact or deterministic; they must be in the form of probability distributions, tolerance limits, or principle-derived sets of correct solutions to tactical problems. After these expectations about casualties and tactical processes have been established, ES outcomes can be compared to them to assess deficiencies and readiness levels.

This study was designed to partially validate a board war game forecasting procedure by determining whether military officers can discriminate between field exercise data and data generated in a board game. Using the field exercise and generated forecast data from the CATEST at Fort Carson, Colo., military officers attempted to distinguish the field maneuver routes from the simulated maneuver routes.

The results suggested that officers could not distinguish the simulated data from the real data, and that a participant's experiential background was not related to the number of correct responses obtained. Furthermore, neither estimated confidence in the response nor admitted guessing were related to the correctness of the response. REALTRAIN experience increased a participant's confidence in his response, but no other background data were related to confidence or admitted guessing. When considering the casualty data, the officers correctly identified the field exercise data in only 20 of 53 cases.

In informal postexperimental question-and-answer periods, the officers said the ES field exercise data seemed unrealistic. They doubted that infantry and grenades could destroy tanks, TOWs, and APCs as was evidenced in the field exercises (Appendix E). They also felt that tanks had too little impact on the field exercise casualties.

The game board data may have seemed more realistic because the officers were not aware of "realistic" casualty data or because the REALTRAIN casualty assessment rules were not appropriate.

In either case, more realistic casualty assessment techniques for ES exercises will be provided in the Multiple Integrated Laser Engagement Simulation (MILES) system, and the forecast game will generate data more closely resembling the field exercise data by strictly adhering to the MILES casualty rules. These developments should eliminate the major discrepancies between the field and forecast casualty data.

The results of this study suggest that military officers cannot distinguish field exercise data from forecast data generated in game board exercises. According to the Turing Test, therefore, these two data sources may be considered to be identical. Game board exercises generate data that are similar enough to field exercise data to be used to determine the characteristics of the distribution of ES outcomes which, in turn, can be used to define performance benchmarks or standards for units participating in ES field exercises.

Although the initial steps in validating the board war game forecasting procedures have been taken, more research is necessary before forecasting can be espoused as a valid, reliable means of generating data for the purpose of establishing behavioral benchmarks or standards. The effects of different levels of training (for the forecasters) on forecasting must be assessed and compared to the effects of different training levels (for the unit) on ES field exercises. If forecasting is to be used to provide behavioral standards, the forecast data should reflect the same types of differences due to training level as are evident in field exercises. As a long-term goal, it would be fruitful to develop learning curves for ES field exercises and forecasting exercises and then compare the two.

A short-term research effort can be directed to developing a relatively large data base for a few selected exercises and then comparing the results observed in the field with the generated expectations. Provided sufficient manpower resources are available, considerably more data than maneuver routes and casualties can be collected and compared with the ES field exercise data. These data may include detection distances and locations, firing patterns of vehicles, indirect fire placement, or communications.

It is then of considerable interest to determine how much and what types of information are necessary for military officers to distinguish between field and forecast data. Determining this additional information will result in a better understanding of the dynamics of tactical behavior and an improved set of forecast procedures. Successive iterations and modifications of the forecasting procedures will help to develop a realistic data base from which performance standards can be derived.

APPENDIX A

SUMMARY OF BACKGROUND INFORMATION ON PARTICIPANTS

Rank: 2LT 1LT CPT MAJ LTC COL
22 22 13 3 3 3

Combat experience: YES NO
12 54

REALTRAIN experience: YES NO
40 26

Board war game experience: YES NO
51 15

Familiarity with test lanes: YES NO
29 37

Years in service: LESS THAN 1 1-2 3-4 5-6 7-12 MORE THAN 12
2 28 16 7 7 6

Education: H.S. COLLEGE POST-GRADUATE
5 7 4

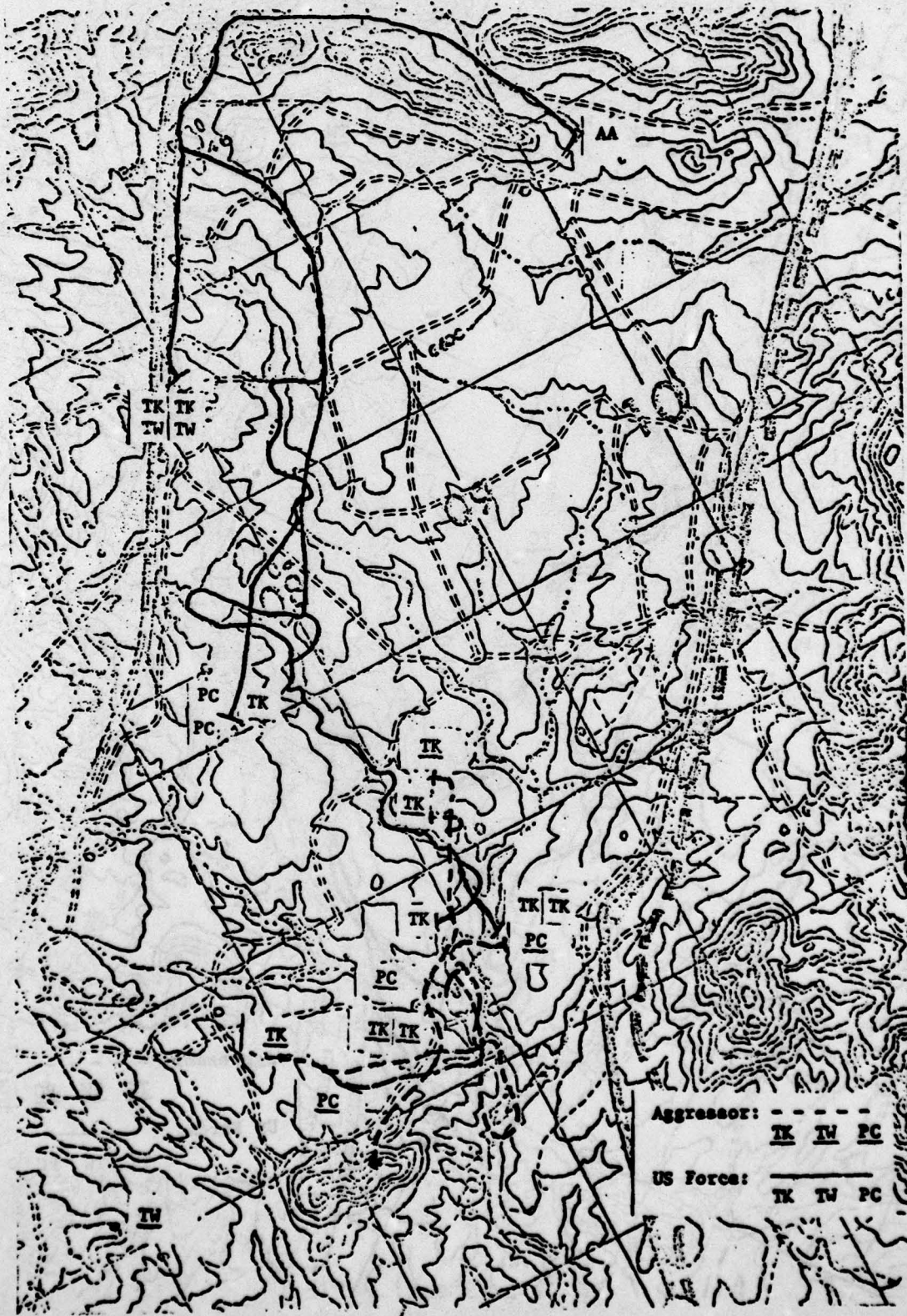
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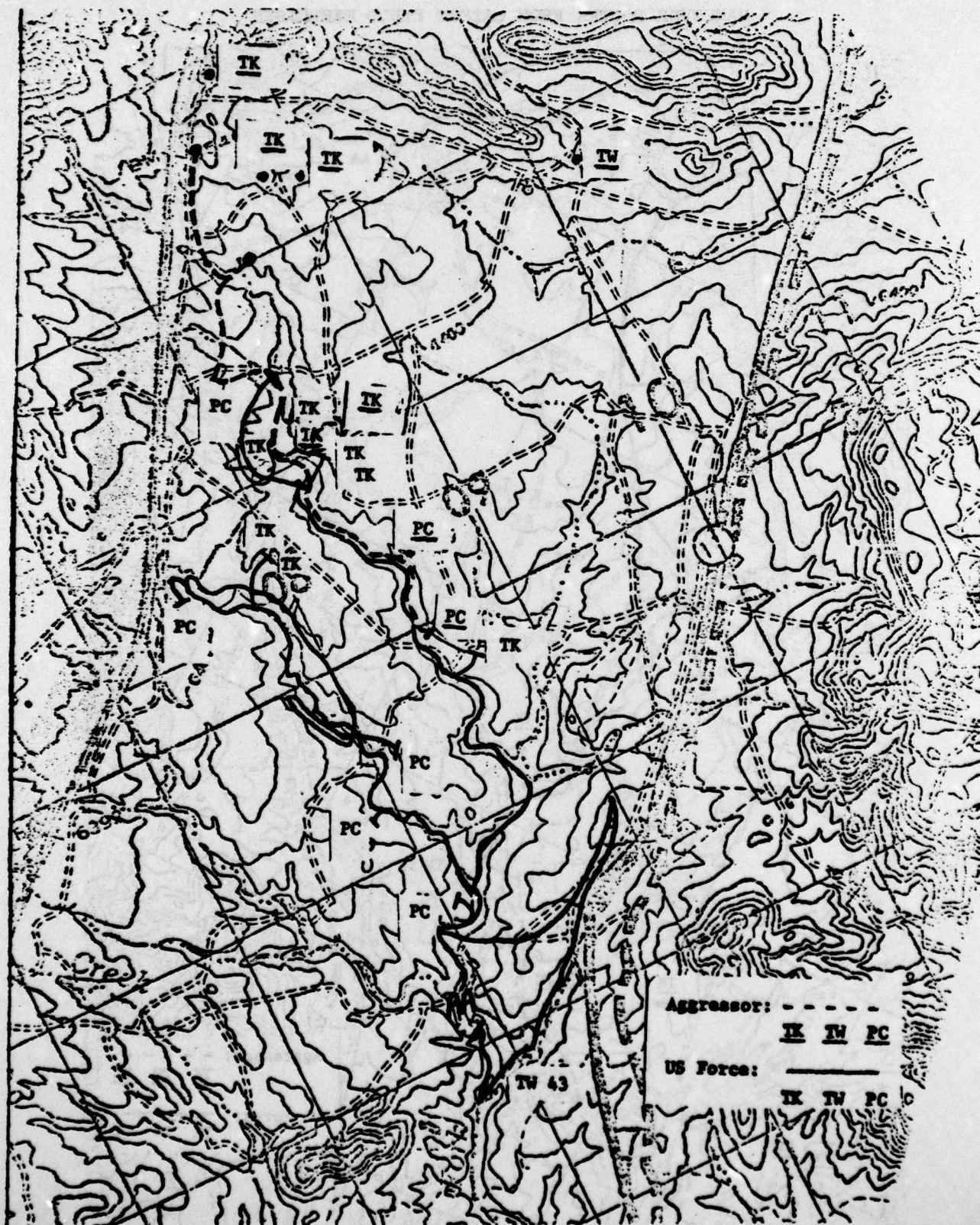
RESPONSE SHEET

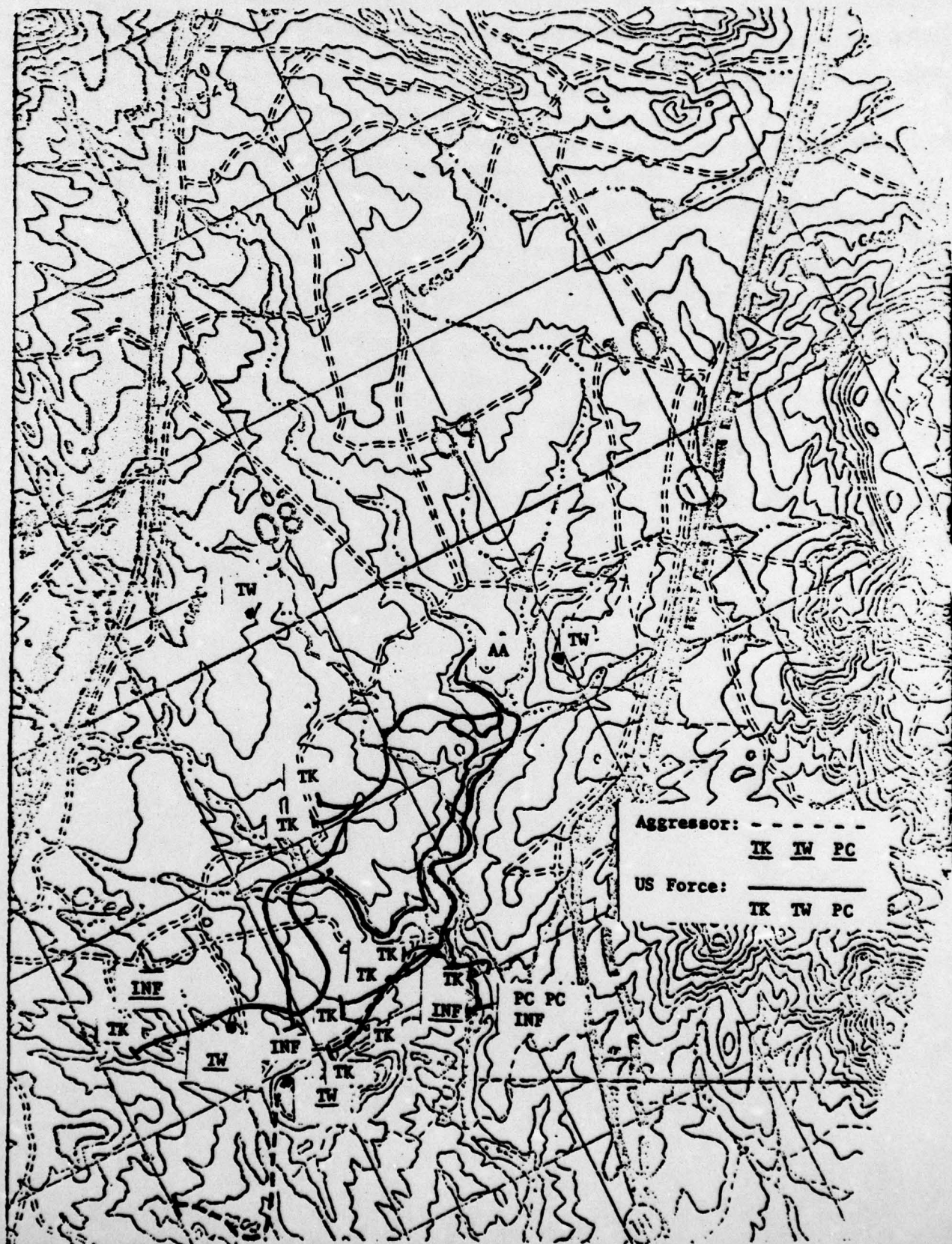
Figure No.	Real/Simulated	How much confidence do you have in your decision?	Are you guessing? (Y/N) If not, what factors influenced your decision?
1.	100% 90 80 70 60 50 40 30 20 10 0%	Confidence	
2.	100% 90 80 70 60 50 40 30 20 10 0%	Confidence	
3.	100% 90 80 70 60 50 40 30 20 10 0%	Confidence	
4.	100% 90 80 70 60 50 40 30 20 10 0%	Confidence	
5.	100% 90 80 70 60 50 40 30 20 10 0%	Confidence	
6.	100% 90 80 70 60 50 40 30 20 10 0%	Confidence	
7.	100% 90 80 70 60 50 40 30 20 10 0%	Confidence	
8.	100% 90 80 70 60 50 40 30 20 10 0%	Confidence	

APPENDIX C

MANEUVER ROUTES FROM CATEST FIELD EXERCISES



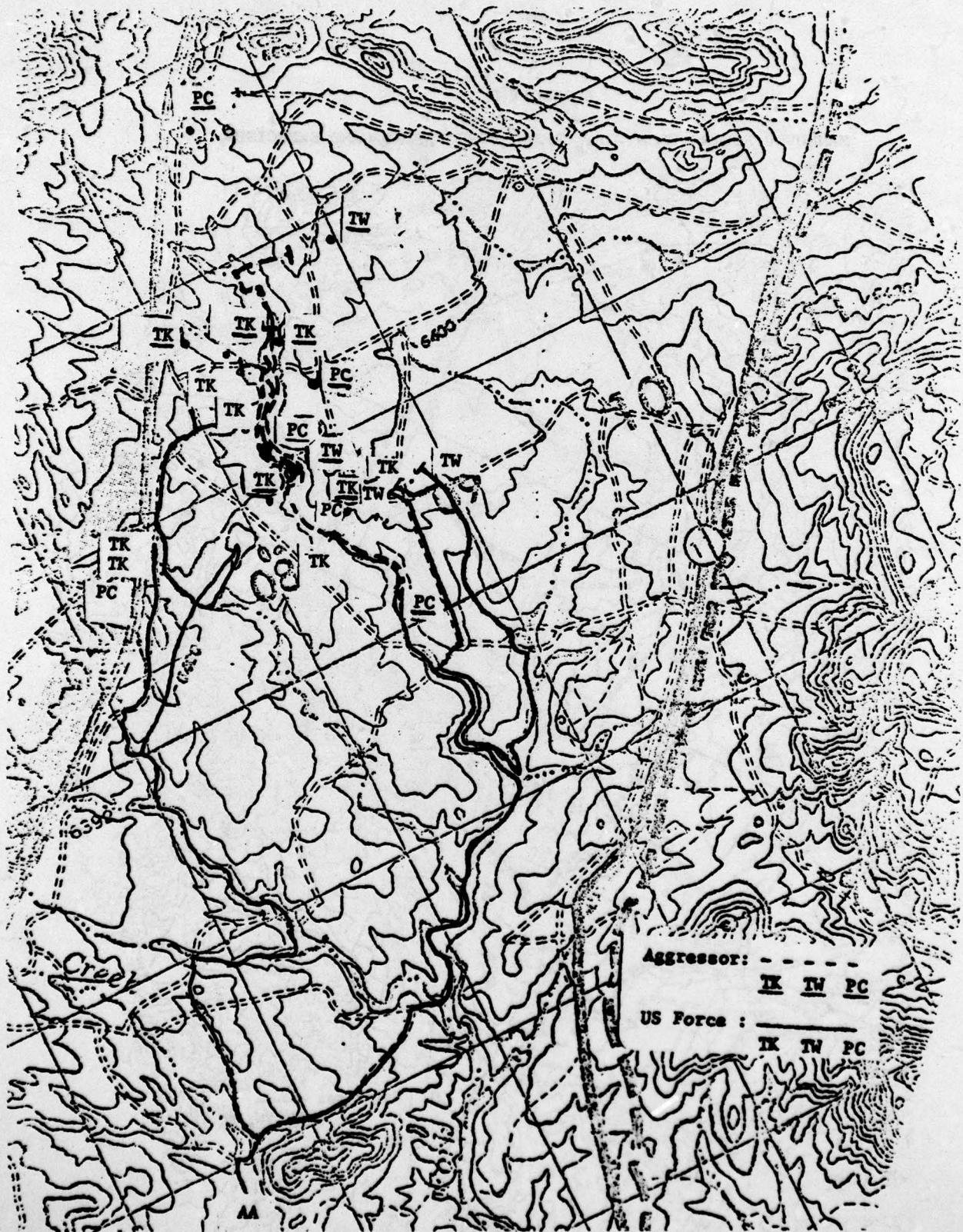


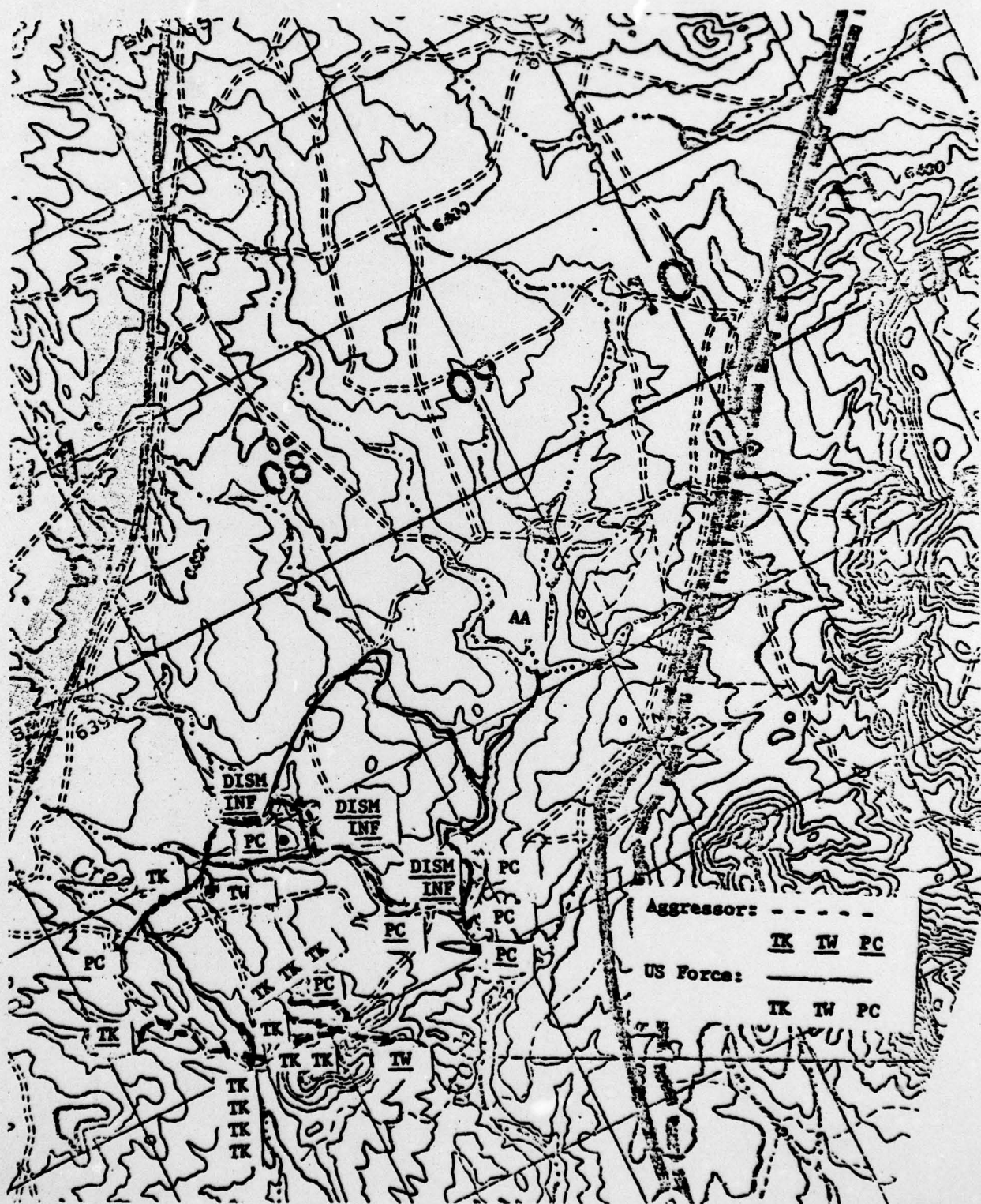


APPENDIX D

MANEUVER ROUTES FROM FORT CARSON FORECASTING GAME EXERCISES







FIELD EXERCISE CASUALTY SUMMARY

21

APPENDIX F

BOARD GAME CASUALTY SUMMARY

Target	Frequencies				
	TOW	TK	APC	1/4T.TR.	INF. TOTAL
Firer Artillery	7	18	6		5 36
TOW	6	20	6		32
Tanks	5	22	9		45 81
APC			1		2 3
LAW		8	6		14
90mm		14	5		19
M60					
Infantry					76 76
Grenade					
Other					
Total	18	82	33		128 261

Target	Percentages				
	TOW	TK	APC	1/4T.TR.	INF. TOTAL
Firer Artillery	3	7	2		2 14
TOW	2	8	2		12
Tanks	2	8	3		17 31
APC			0		1 1
LAW		3	2		5
90mm		5	2		7
M60					
Infantry					29 29
Grenade					
Other					
Total	7	31	13		49

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 1 USA Armament Cmd, Rock Island, ATTN: AMSAR-TDC
 1 FAA-NAFEC, Atlantic City, ATTN: Library
 1 FAA-NAFEC, Atlantic City, ATTN: Human Engr Br
 1 FAA Aeronautical Ctr, Oklahoma City, ATTN: AAC-44D
 2 USA Fld Arty Sch, Ft Sill, ATTN: Library
 1 USA Armor Sch, Ft Knox, ATTN: Library
 1 USA Armor Sch, Ft Knox, ATTN: ATSB-DI-E
 1 USA Armor Sch, Ft Knox, ATTN: ATSB-DT-TP
 1 USA Armor Sch, Ft Knox, ATTN: ATSB-CD-AD
 2 HQUSACDEC, Ft Ord, ATTN: Library
 1 HQUSACDEC, Ft Ord, ATTN: ATEC-EX-E-Hum Factors
 2 USAEEC, Ft Benjamin Harrison, ATTN: Library
 1 USAPACDC, Ft Benjamin Harrison, ATTN: ATCP-HR
 1 USA Comm-Elect Sch, Ft Monmouth, ATTN: ATSN-EA
 1 USAEC, Ft Monmouth, ATTN: AMSEL-CT-HDP
 1 USAEC, Ft Monmouth, ATTN: AMSEL-PA-P
 1 USAEC, Ft Monmouth, ATTN: AMSEL-SI-CB
 1 USAEC, Ft Monmouth, ATTN: C, Fac Dev Br
 1 USA Materials Sys Anal Agcy, Aberdeen, ATTN: AMXS-P
 1 Edgewood Arsenal, Aberdeen, ATTN: SAREA-BL-H
 1 USA Ord Ctr & Sch, Aberdeen, ATTN: ATSL-TEM-C
 2 USA Hum Engr Lab, Aberdeen, ATTN: Library/Dir
 1 USA Combat Arms Tng Bd, Ft Benning, ATTN: Ad Supervisor
 1 USA Infantry Hum Rsch Unit, Ft Benning, ATTN: Chief
 1 USA Infantry Bd, Ft Benning, ATTN: STEBC-TE-T
 1 USASMA, Ft Bliss, ATTN: ATSS-LRC
 1 USA Air Def Sch, Ft Bliss, ATTN: ATSA-CTD-ME
 1 USA Air Def Sch, Ft Bliss, ATTN: Tech Lib
 1 USA Air Def Bd, Ft Bliss, ATTN: FILES
 1 USA Air Def Bd, Ft Bliss, ATTN: STEBD-PO
 1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: Lib
 1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: ATSW-SE-L
 1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: Ed Advisor
 1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: DepCdr
 1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: CCS
 1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: ATCASA
 1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: ATCACO-E
 1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: ATCACO-CI
 1 USAECOM, Night Vision Lab, Ft Belvoir, ATTN: AMSEL-NV-SD
 3 USA Computer Sys Cmd, Ft Belvoir, ATTN: Tech Library
 1 USAMERDC, Ft Belvoir, ATTN: STSFB-DQ
 1 USA Eng Sch, Ft Belvoir, ATTN: Library
 1 USA Topographic Lab, Ft Belvoir, ATTN: ETL-TD-S
 1 USA Topographic Lab, Ft Belvoir, ATTN: STINFO Center
 1 USA Topographic Lab, Ft Belvoir, ATTN: ETL-GSL
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: CTD-MS
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATS-CTD-MS
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-TE
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-TEX-GS
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-CTS-OR
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-CTD-DT
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-CTD-CS
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: DAS/SRD
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-TEM
 1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: Library
 1 CDR, HQ Ft Huachuca, ATTN: Tech Ref Div
 2 CDR, USA Electronic Prg Grd, ATTN: STEEP-MT-S
 1 HQ, TCATA, ATTN: Tech Library
 1 HQ, TCATA, ATTN: ATCAT-OP-Q, Ft Hood
 1 USA Recruiting Cmd, Ft Sheridan, ATTN: USARCPM-P
 1 Senior Army Adv., USAFAGOD/TAC, Elgin AF Aux Fld No. 9
 1 HQ, USARPAC, DCSPER, APO SF 96568, ATTN: GPPE-SE
 1 Stimson Lib, Academy of Health Sciences, Ft Sam Houston
 1 Marine Corps Inst., ATTN: Dean-MCI
 1 HQ, USMC, Commandant, ATTN: Code MTMT
 1 HQ, USMC, Commandant, ATTN: Code MPI-20-28
 2 USCG Academy, New London, ATTN: Admission
 2 USCG Academy, New London, ATTN: Library
 1 USCG Training Ctr, NY, ATTN: CO
 1 USCG Training Ctr, NY, ATTN: Educ Svc Ofc
 1 USCG, Psychol Res Br, DC, ATTN: GP 1/62
 1 HQ Mid-Range Br, MC Det, Quantico, ATTN: P&S Div

1 US Marine Corps Liaison Ofc, AMC, Alexandria, ATTN: AMCGS-F
 1 USATRADOC, Ft Monroe, ATTN: ATRO-ED
 6 USATRADOC, Ft Monroe, ATTN: ATRP-AD
 1 USATRADOC, Ft Monroe, ATTN: ATTS-EA
 1 USA Forces Cmd, Ft McPherson, ATTN: Library
 2 USA Aviation Test Bd, Ft Rucker, ATTN: STEBG-PO
 1 USA Agcy for Aviation Safety, Ft Rucker, ATTN: Library
 4 USA Agcy for Aviation Safety, Ft Rucker, ATTN: Educ Advisor
 1 USA Aviation Sch, Ft Rucker, ATTN: PO Drawer O
 1 HQUSA Aviation Sys Cmd, St Louis, ATTN: AMSAV-ZDR
 2 USA Aviation Sys Test Act., Edwards AFB, ATTN: SAVTE-T
 1 USA Air Def Sch, Ft Bliss, ATTN: ATSA TEM
 1 USA Air Mobility Rsch & Dev Lab, Moffett Fld, ATTN: SAVDL-AS
 1 USA Aviation Sch, Res Tng Mgt, Ft Rucker, ATTN: ATST-T-RTM
 1 USA Aviation Sch, CO, Ft Rucker, ATTN: ATST-D-A
 1 HQ, DARCOM, Alexandria, ATTN: AMXCD-TL
 1 HQ, DARCOM, Alexandria, ATTN: CDR
 1 US Military Academy, West Point, ATTN: Serials Unit
 1 US Military Academy, West Point, ATTN: Ofc of Milt Ldrshp
 1 US Military Academy, West Point, ATTN: MAOR
 1 USA Standardization Gp, UK, FPO NY, ATTN: MASE-GC
 1 Ofc of Naval Rsch, Arlington, ATTN: Code 452
 3 Ofc of Naval Rsch, Arlington, ATTN: Code 458
 1 Ofc of Naval Rsch, Arlington, ATTN: Code 450
 1 Ofc of Naval Rsch, Arlington, ATTN: Code 441
 1 Naval Aerosp Med Res Lab, Pensacola, ATTN: Acous Sch Div
 1 Naval Aerosp Med Res Lab, Pensacola, ATTN: Code L51
 1 Naval Aerosp Med Res Lab, Pensacola, ATTN: Code L5
 1 Chief of NavPers, ATTN: Pers-OR
 1 NAVAIRSTA, Norfolk, ATTN: Safety Ctr
 1 Nav Oceanographic, DC, ATTN: Code 6251, Charts & Tech
 1 Center of Naval Anal, ATTN: Doc Ctr
 1 NavAirSysCom, ATTN: AIR-5313C
 1 Nav BuMed, ATTN: 713
 1 NavHelicopterSubSqs 2, FPO SF 98601
 1 AFHRL (FT) Williams AFB
 1 AFHRL (TT) Lowry AFB
 1 AFHRL (AS) WPAFB, OH
 2 AFHRL (DOJZ) Brooks AFB
 1 AFHRL (DOJN) Lackland AFB
 1 HQUASAF (INYSO)
 1 HQUASAF (DPXXA)
 1 AFVTG (RD) Randolph AFB
 3 AMRL (HE) WPAFB, OH
 2 AF Inst of Tech, WPAFB, OH, ATTN: ENE/SL
 1 ATC (XPTD) Randolph AFB
 1 USAF AeroMed Lib, Brooks AFB (SUL-4), ATTN: DOC SEC
 1 AFOSR (NL), Arlington
 1 AF Log Cmd, McClellan AFB, ATTN: ALC/DPCRB
 1 Air Force Academy, CO, ATTN: Dept of Bel Scn
 5 NavPers & Dev Ctr, San Diego
 2 Navy Med Neuropsychiatric Rsch Unit, San Diego
 1 Nav Electronic Lab, San Diego, ATTN: Res Lab
 1 Nav TrngCen, San Diego, ATTN: Code 9000-Lib
 1 NavPostGraSch, Monterey, ATTN: Code 55Aa
 1 NavPostGraSch, Monterey, ATTN: Code 2124
 1 NavTrngEquipCtr, Orlando, ATTN: Tech Lib
 1 US Dept of Labor, DC, ATTN: Manpower Admin
 1 US Dept of Justice, DC, ATTN: Drug Enforce Admin
 1 Nat Bur of Standards, DC, ATTN: Computer Info Section
 1 Nat Clearing House for MH-Info, Rockville
 1 Denver Federal Ctr, Lakewood, ATTN: BLM
 12 Defense Documentation Center
 4 Dir Psych, Army Hq, Russell Ofcs, Canberra
 1 Scientific Advsr, Mil Bd, Army Hq, Russell Ofcs, Canberra
 1 Mil and Air Attache, Austrian Embassy
 1 Centre de Recherche Des Facteurs Humains de la Defense Nationale, Brussels
 2 Canadian Joint Staff Washington
 1 C/Air Staff, Royal Canadian AF, ATTN: Pers Std Anal Br
 3 Chief, Canadian Def Rsch Staff, ATTN: C/CRDS(W)
 4 British Def Staff, British Embassy, Washington

1 Def & Civil Inst of Enviro Medicine, Canada
 1 AIR CRESS, Kensington, ATTN: Info Sys Br
 1 Militaerpsychologisk Tjeneste, Copenhagen
 1 Military Attache, French Embassy, ATTN: Doc Sec
 1 Medecin Chef, C.E.R.P.A.-Arsenal, Toulon/Naval France
 1 Prin Scientific Off, Appl Hum Engr Rsch Div, Ministry of Defense, New Delhi
 1 Pers Rsch Ofc Library, AKA, Israel Defense Forces
 1 Ministeris van Defensie, DOOP/KL Afd Sociaal Psychologische Zaken, The Hague, Netherlands